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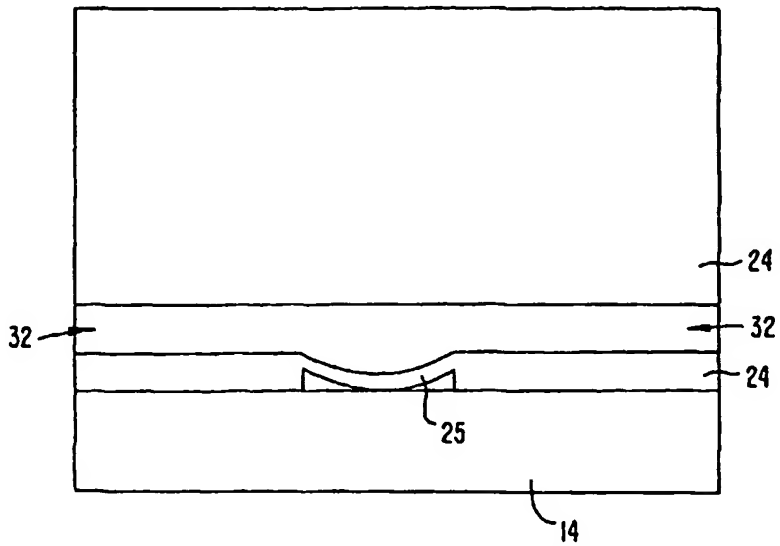
(54) Title: MICROFABRICATED ELASTOMERIC VALVE AND PUMP SYSTEMS




(57) Abstract: A method of fabricating an elastomeric structure, comprising: forming a first elastomeric layer on top of a first micromachined mold, the first micromachined mold having a first raised protrusion which forms a first recess extending along a bottom surface of the first elastomeric layer; forming a second elastomeric layer on top of a second micromachined mold, the second micromachined mold having a second raised protrusion which forms a second recess extending along a bottom surface of the second elastomeric layer; bonding the bottom surface of the second elastomeric layer onto a top surface of the first elastomeric layer such that a control channel forms in the second recess between the first and second elastomeric layers; and positioning the first elastomeric layer on top of a planar substrate such that a flow channel forms in the first recess between the first elastomeric layer and the planar substrate.

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Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

**Published:**
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*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

# INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 01/44549

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 F04B43/04 F15C5/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 F04B F15C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X | US 5 346 372 A (NARUSE YOSHIHIRO ET AL)<br>13 September 1994 (1994-09-13) | 21,22 |
| Y | abstract | 1,3,4 |
| A | column 2, line 26 -column 5, line 20<br>figures 1-12 | 2,5,6,15 |
| | --- | |
| Y | US 6 043 080 A (FODOR STEPHEN P A ET AL)<br>28 March 2000 (2000-03-28) | 1,3,4 |
| A | abstract | 15 |
| | column 15, line 65 -column 17, line 21<br>column 19, line 54 -column 21, line 13<br>figures 2,5 | |
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| X | EP 0 779 436 A (HARTLEY FRANK T)<br>18 June 1997 (1997-06-18) | 35,37 |
| A | abstract | 1,2,5 |
| | column 3, line 41 -column 6, line 4<br>figures 1-7 | |
| | --- | |
| | -/-- | |

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 12 July 2002 | 29. 10. 2002 |

| Name and mailing address of the ISA | Authorized officer |
|---|---|
| European Patent Office, P.B. 5818 Patentlaan 2<br>NL - 2280 HV Rijswijk<br>Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,<br>Fax (+31-70) 340-3016 | Kolby, L |

Form PCT/ISA/210 (second sheet) (July 1992)

# INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 01/44549

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X | POL VAN DE F C M ET AL: "A THERMO-PNEUMATIC ACTUATION PRINCIPLE FOR A MICROMINIATURE PUMP AND OTHER MICROMECHANICAL DEVICES" SENSORS AND ACTUATORS, ELSEVIER SEQUOIA S.A. LAUSANNE, CH, vol. 17, no. 1/2, 3 May 1989 (1989-05-03), pages 139-143, XP000038020 | 35,36 |
| A | page 139, paragraph 1 -page 141, paragraph 2 | 1,5 |
| A | US 5 088 515 A (KAMEN DEAN L) 18 February 1992 (1992-02-18) abstract column 3, line 53 -column 7, line 37 figures 1-7 | 1,3,4,15 |
| A | US 4 245 673 A (BOUTEILLE DANIEL ET AL) 20 January 1981 (1981-01-20) column 4, line 46 - line 51 figures 3,4 | 5 |

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

# INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 01/44549

## Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-4, 5-11, 15, 35-38

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-4,5-11,15,35-38

   A microfluidic structure having integral membrane portion
   A method of microfabricating an elastomeric structure

2. Claims: 12-14,83

   A method for forming a via in a microfabricated elastomer structure

3. Claims: 16-20,39-45

   A composite structure with a separate membrane member
   A method of forming a composite structure

4. Claims: 21-34

   A composite structure comprising an active device
   A method of fabricating a composite structure with an active device

5. Claims: 46-53

   A fluidic logic device

6. Claims: 54-58,59-61

   A pressure amplifier
   A method of amplifying a pressure in a flow channel

7. Claims: 62-65

   A one way valve in a microfabricated channel

8. Claims: 66-67

   A method of filling a microfabricated elastomeric structure with fluid

9. Claims: 68-70

   A method of metering a volume of fluid

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

10. Claims: 71-74,79-82

A method of promoting adhesion between layers of micfofabricated structure
A method of fabricating an elastomeric structure

11. Claims: 75-77,78

A method of actuating a microfabricated elastomeric structure comprising an aqueous salt solution

A microfabricated syringe structure comprising an aqueous salt solution

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International Application No
PCT/US 01/44549

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